



BHUVAN

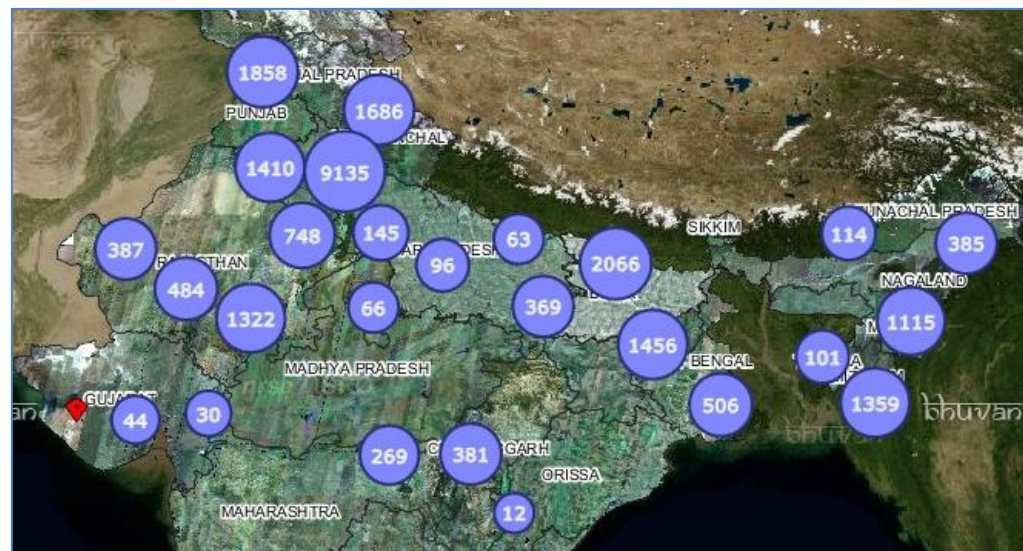
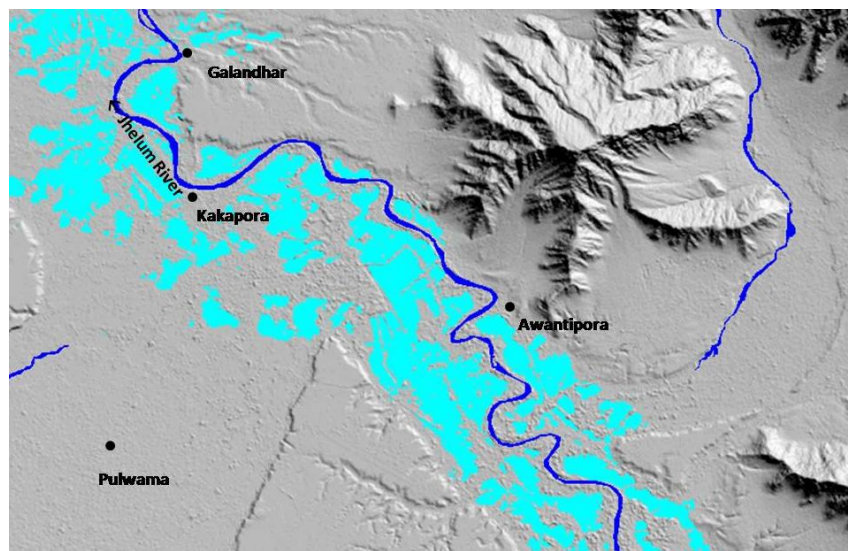


Disaster Risk Reduction, Damage Assessment and Response

UNITED Nations/India Workshop

8-10, March 2016

The Geo-Platform Supporting Disasters



www.bhuvan.nrsc.gov.in

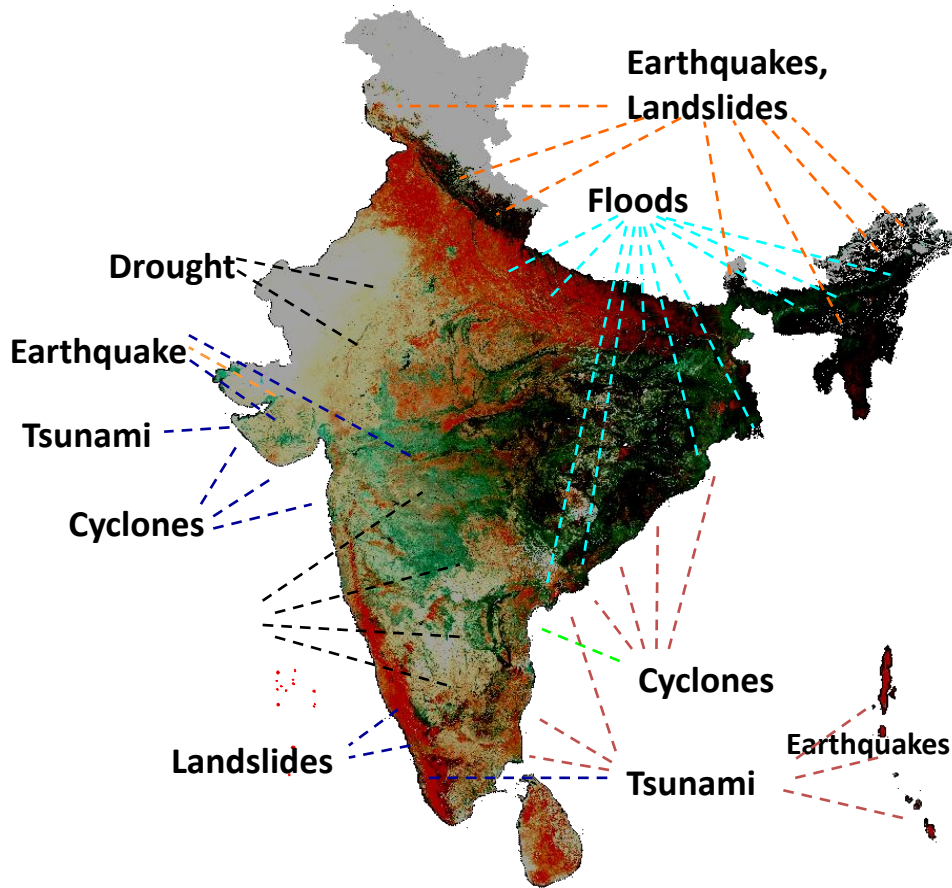
National Remote Sensing Centre

Indian Space Research Organization
Department of Space, Hyderabad

Vinod M Bothale

Group Director
Geoportal and WebGIS Services

India and the Disasters



27 States & Union Territories are disaster prone

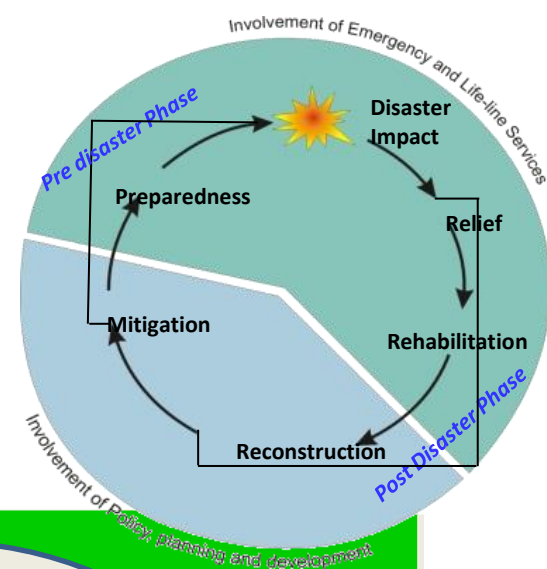
- 12% of land area (40 mha) - Flood prone
- 8% of land area (along 5,500 km long coast tract) - Cyclone prone
- Over 65% of land under cultivation - Drought prone
- Around 25% land area - Earthquake prone - Seismic zone IV-V
- Himalayan and Western Ghats region - Landslide prone
- Andaman Nicobar Islands, parts of East Coast, and Gujarat coast – Tsunami

Average Annual Loss

- Direct: Loss of life: 4350 ; Crop area affected: 1.42 Mha; Houses damaged: 2.36 M; Direct loss: 2 % of the GDP (Rs. 25000 Cr)
- Indirect: Expenses on emergency response and relief ; diversion of developmental fund; Indirect socio-psychological losses that can not be quantified

The Indian Sub-Continent is among the World's Most Disaster-prone Areas

Disaster Management & Risk Reduction



Sub-systems

Early Warning

Risk Information

Impact Assessment

Preparedness

Emergency
Communication

Early warning for Landslide
Forecast : Run-off

Info. on terrain
socio-econ
Historical

Pre and
identifi

Creation
develop
reconstru

Mobile Apps for
situational help

How does
BHUVAN
Support ?

Apps for

BHUVAN SUPPORT



1

Visualization
Platform



2

Platform for
Building User
Applications



6

Platform for
Mapping



3

Platform for
Building Mobile
Applications



4

Platform for
Free Data
Clearing House



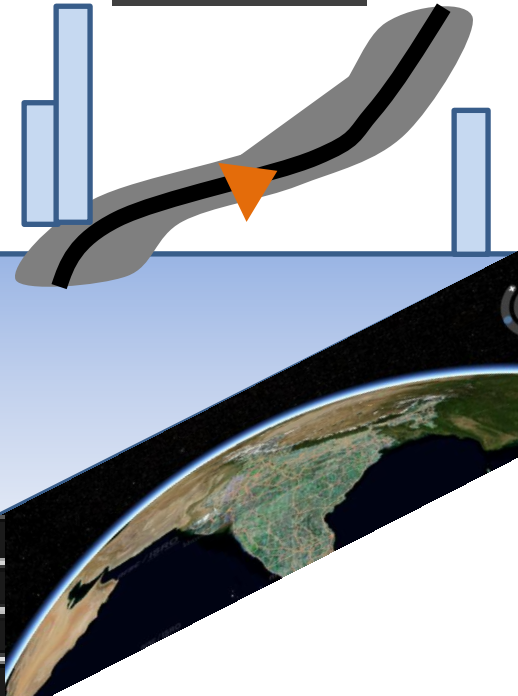
7

Platform for
Disaster Support



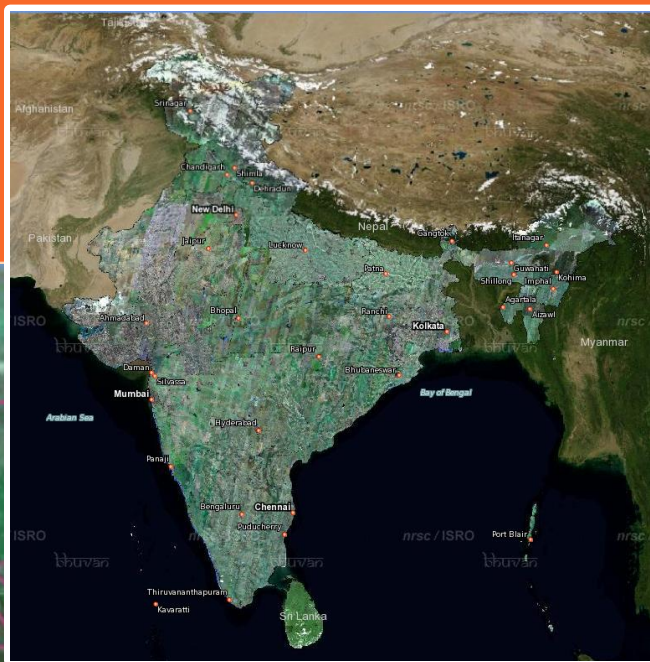
5

Platform for
Navigation



Bhuvan Geo-Platform

Visualization : National to Local up to Cadastre





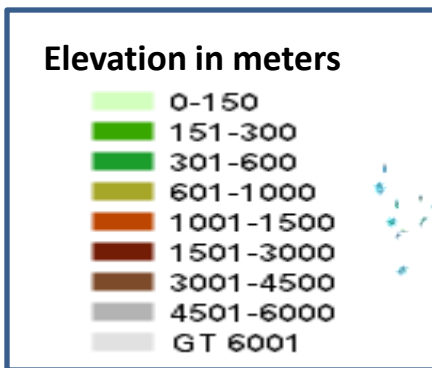
Map | ▼

bhuvan





1. India
2. Pakistan
3. Afghanistan
4. Nepal
5. Bhutan
6. Bangladesh

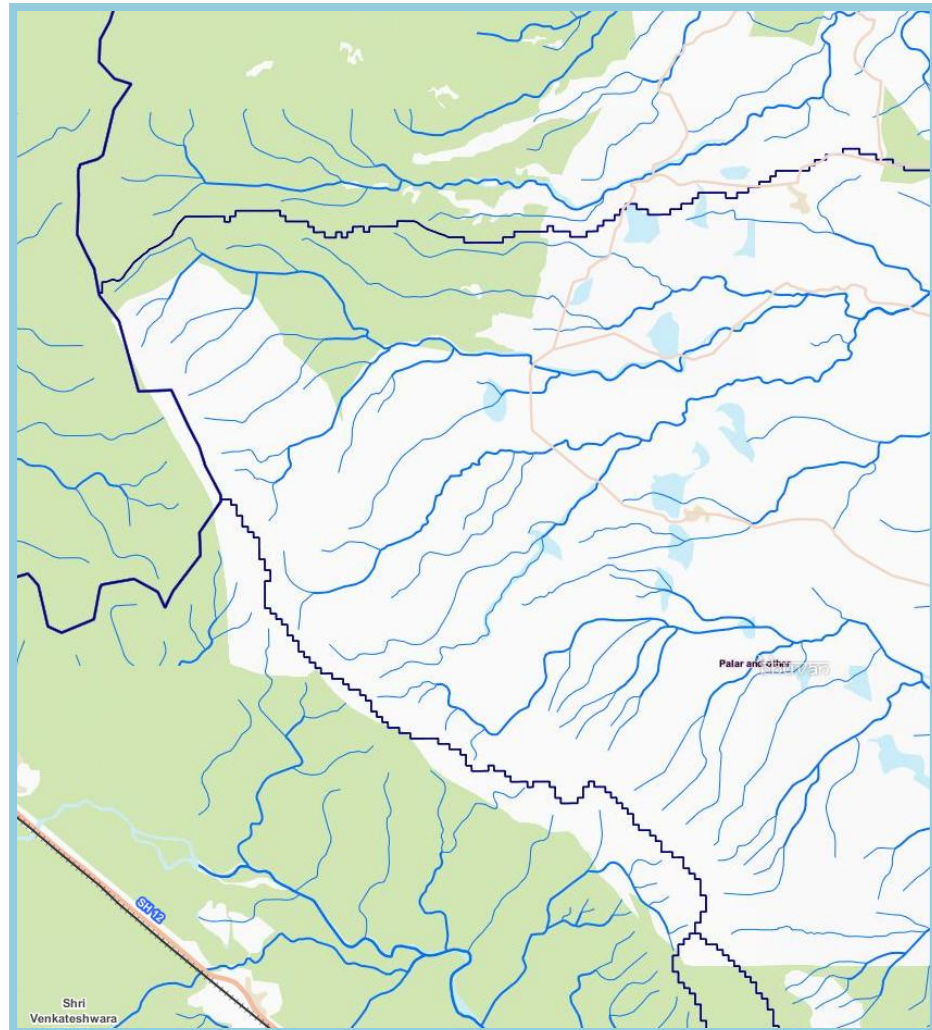
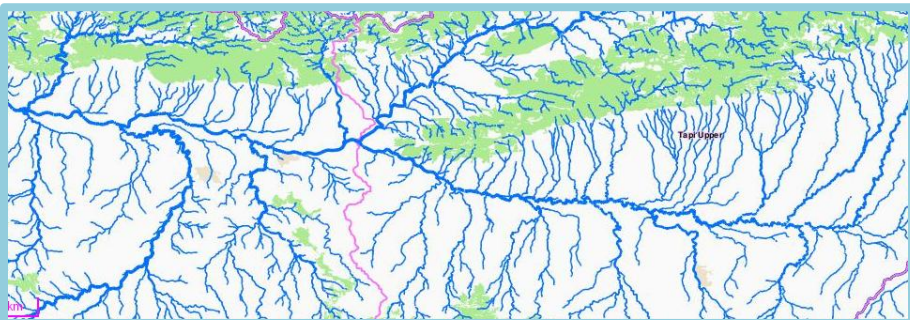
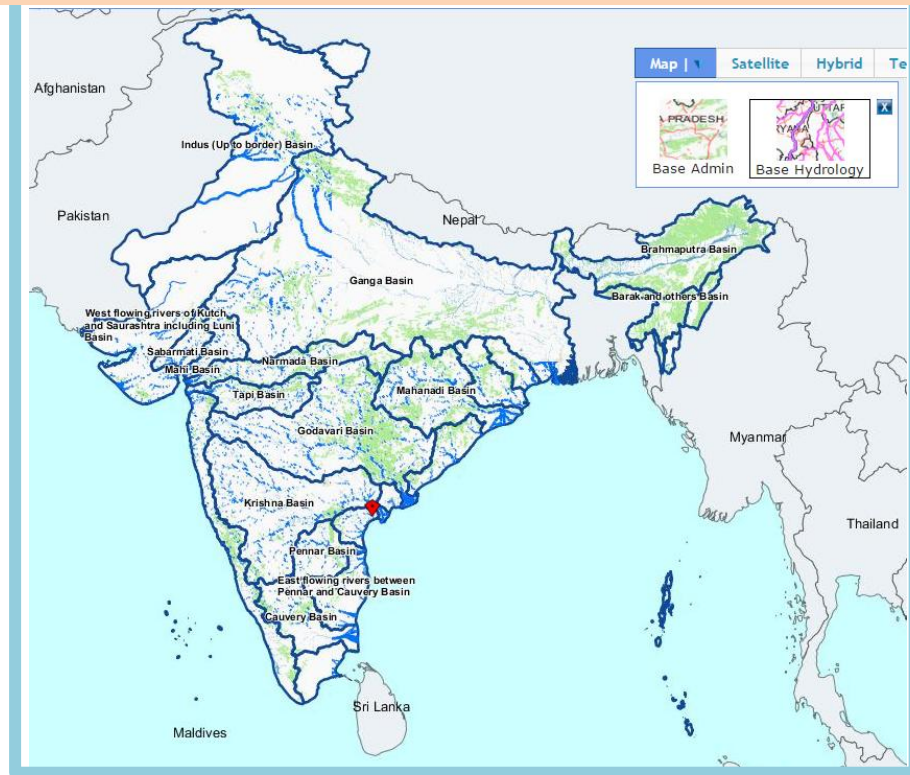


“1377 tiles, 10.1 GB”

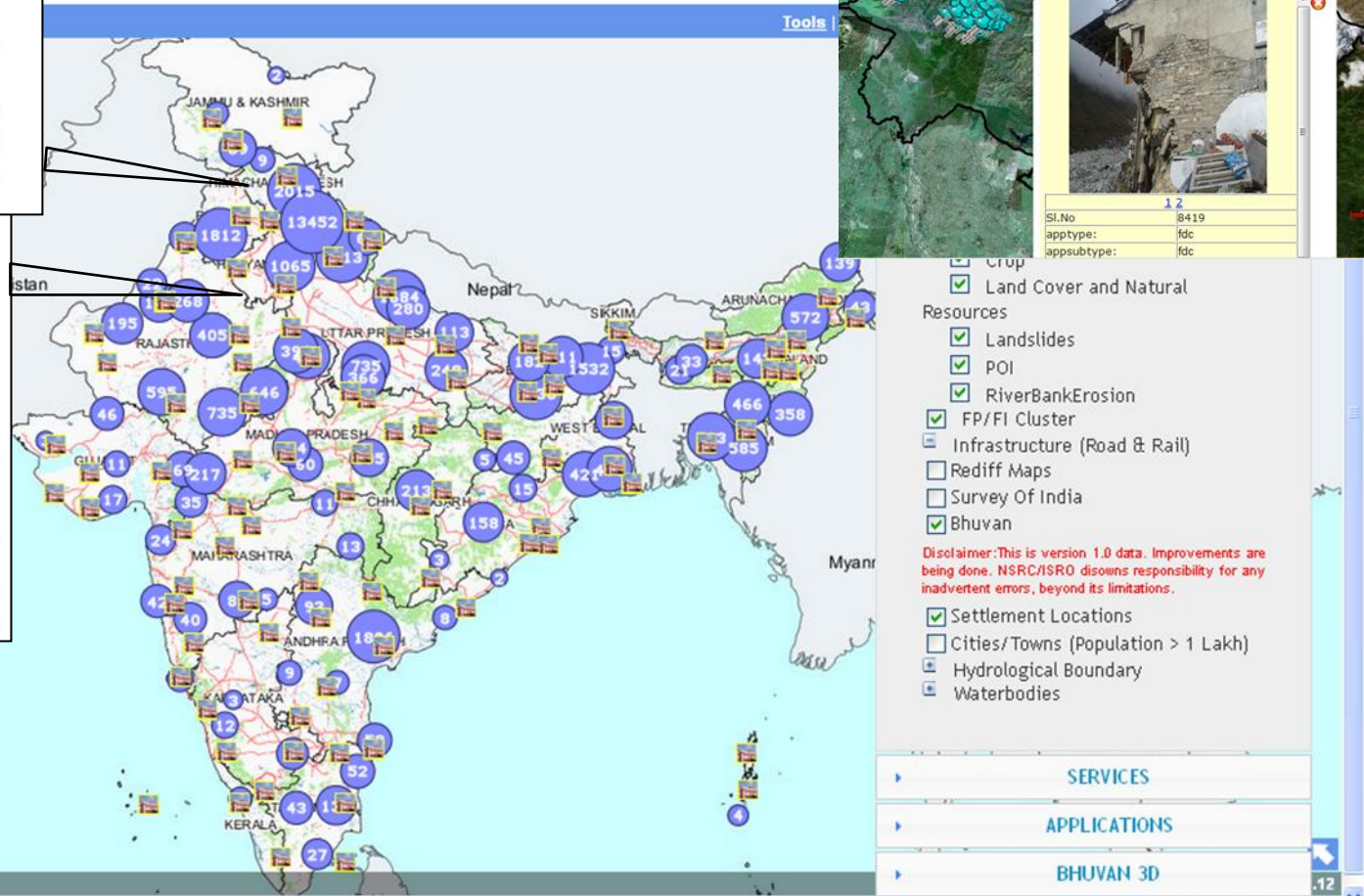
Version	Count	Volume in GB (Compressed)
1	376	2.53
1.1	86	0.4
2	372	2.76
3	543	4.5

HYDROLOGIC BASE

River Basins to Micro-watersheds



Information	Type of Crop:mustard Crop Health Condition:Average
Posted Time	2014-01-10 14:34:04
Posted By	Neetu Rathi



Govt and Citizen Centric Crowd Sourcing

Project	Count
Add Content	2279
Geo-tagging of houses	3764761
Bhuvan Public POI	3774
Crop Cutting	851
Geoscience FDC	114
Hudhud Cyclone	25888
IWMP	21000
Post	140000
MANU	20228
NCFCCrop	12182
SISDP-Asset	2066



**Crowd
Sourcing
4 Million**

Postal Services

No of Offices Geo-tagged	159526
No of Offices Moderated	134830

Election GIS

Total No of Polling Stations	69014
Updated Polling Stations	69013

OGC Standards
Compliant

Web Map Services (WMS)

Satellite data,

Bhuvan base map

Thematic Maps

Services
WMS
> 6200

Bhuvan-Thematic Services facilitate the users to select, browse and portal. Users can consume these Thematic Datasets and integrate Services.

Search

Statistics

Analysis

Metadata

WebServices

Select Theme

Select
Geography

View

Select

Select

Land Use Land Cover(50K):2005-06

Land Use Land Cover(50K):2011-12

Land Use Land Cover(250K)

Land Use Land Cover (10K):SIS-DP

Urban Land Use (10K) :NUIS

Wasteland(50K):2008-09

Glacial Lakes/Waterbodies

Geomorphology(50K):2005-06

Lineament(50K)

Flood Hazard

Flood Annual Layers

Erosion (50K): 2005-06

Salt Affected and Waterlogging (50K):2005-06

Water Bodies

Urban Sprawl

Satellite Data	1m (400+ Cities, 5 Lakh Sq Km) , 2.5 m (India). Locational Multi-Date
Base Map	Scale based (1:50,000 to 1:10,000) 1:10,000 : - 80% of India and 152 towns from NUIS Projects Administrative and Hydrologic Base 10 Million Point of Interest Data
Thematic Maps	15 Themes with Web Map Services
Data Download	Total downloads : 4.7 Lakhs NICES Products : 31,000 + DEM : India + 5 Countries
Disaster Services	6 Disasters , NRT Support for Cyclone, Flood, Landslides, Forest fire • Live Map Upload from DSC, • Automated Forest Fire Alert
Applications	45
State Portals	30
Ministry Portals	22

DATA
20 TB as
Web
Maps

Services
WMS
6204

Crowd
Sourcing
> 39Lakhs



10 Million POI

“Open Source Geospatial Approach & OGC compliance Services”

DISASTERS : Near Real Time Support

Cyclone

Flood

Landslides

Forest Fires

Earthquake

Droughts

- **Historical Floods**
- **Flood Annual Layers**
- **Flood Hazard Layers**
- **Daily Forest Fires**
- **Drought with Indices**
- **Landslide Inventory**
- **Landslide Early Warning**
- **Hydrologic Processes**

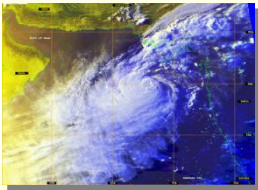
Disaster Management Support

Floods



- Flood Inundation Maps
- Damage Assessment
- Hazard Zonation
- Annual Flood Inundation

Weather & Cyclone



- Intensity & track prediction
- Warnings & Alerts
- Heat wave alerts
- Damage Assessment

- Cyclone Tracks
- Historical Floods
- Flood Annual Layers
- Flood Hazard Layers
- **Daily Forest Fires**
- Drought with Indices
- Landslide Inventory
- Landslide Early Warning
- Hydrologic Processes

Drought



- Monthly Agril. Drought Report
- End-of-the-Season Agril. Drought Report
- Carried out by MNCFC

Forest Fire



- Active Fire Detection
- Damage Assessment

Landslide



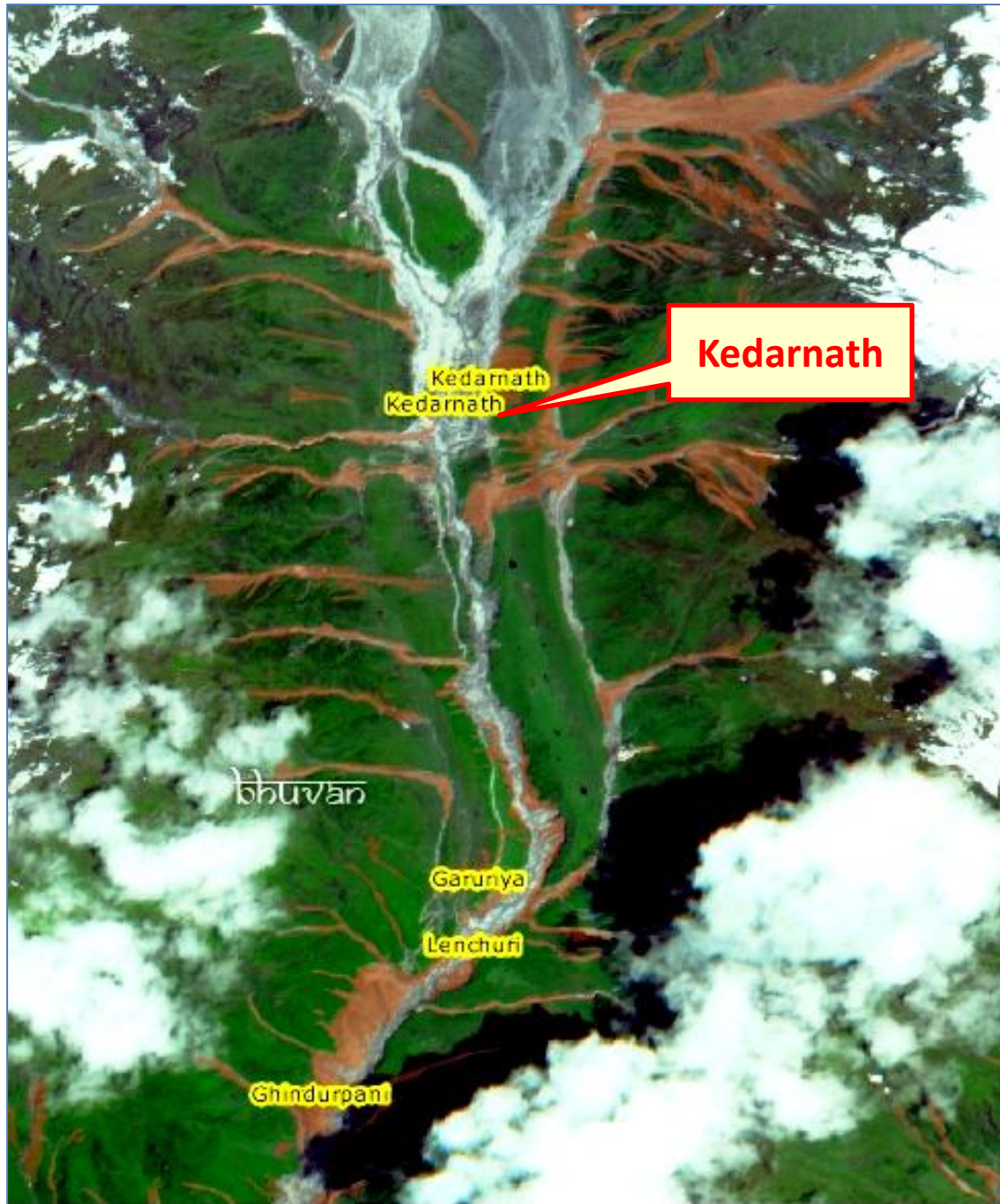
- Damage Assessment
- Hazard zonation
- Rainfall induced landslide forecast

Earthquake



- Damage Assessment

Landslide occurred during Kedarnath Disaster 2013

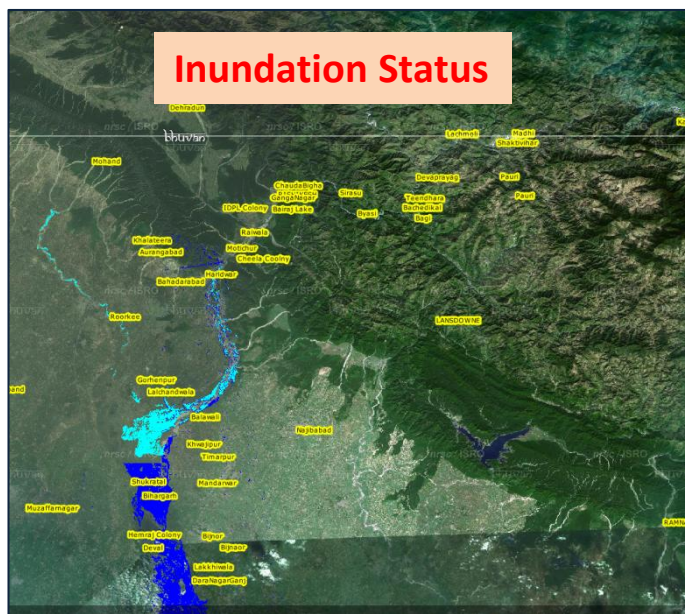


Landslide areas in
neighborhoods of
Kedarnath



**2013 Uttarakhand
during Kedarnath
Disaster
Landslides - 6595**

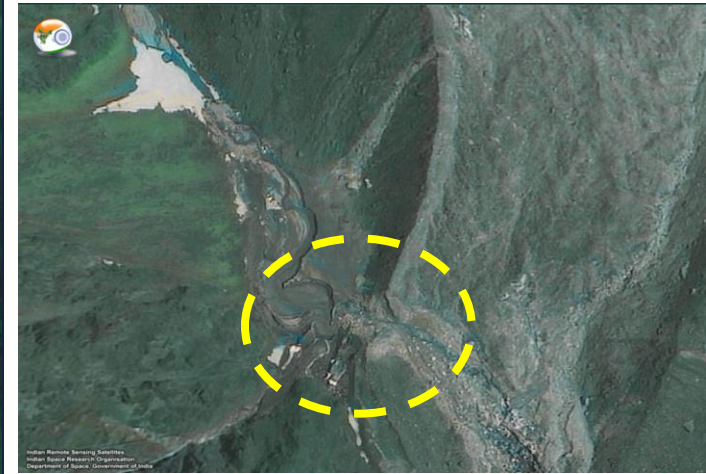
Inundation Status



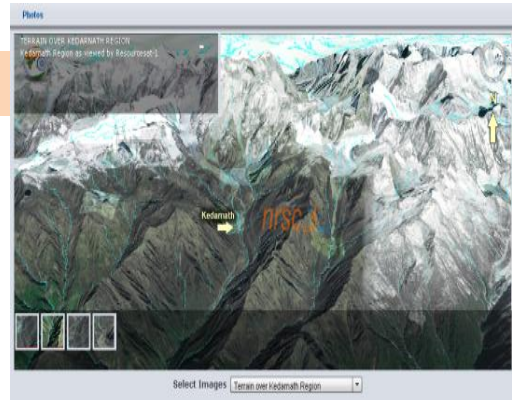
Kedarnath View High Resolution



Ponding and Breach at Chorabari Glacier



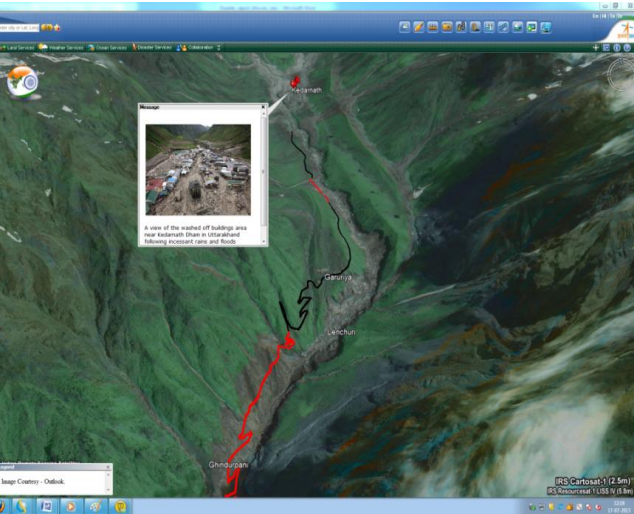
Videos from Bhuvan- 3D



Mobile Viewer for Pre-Post Flood Changes



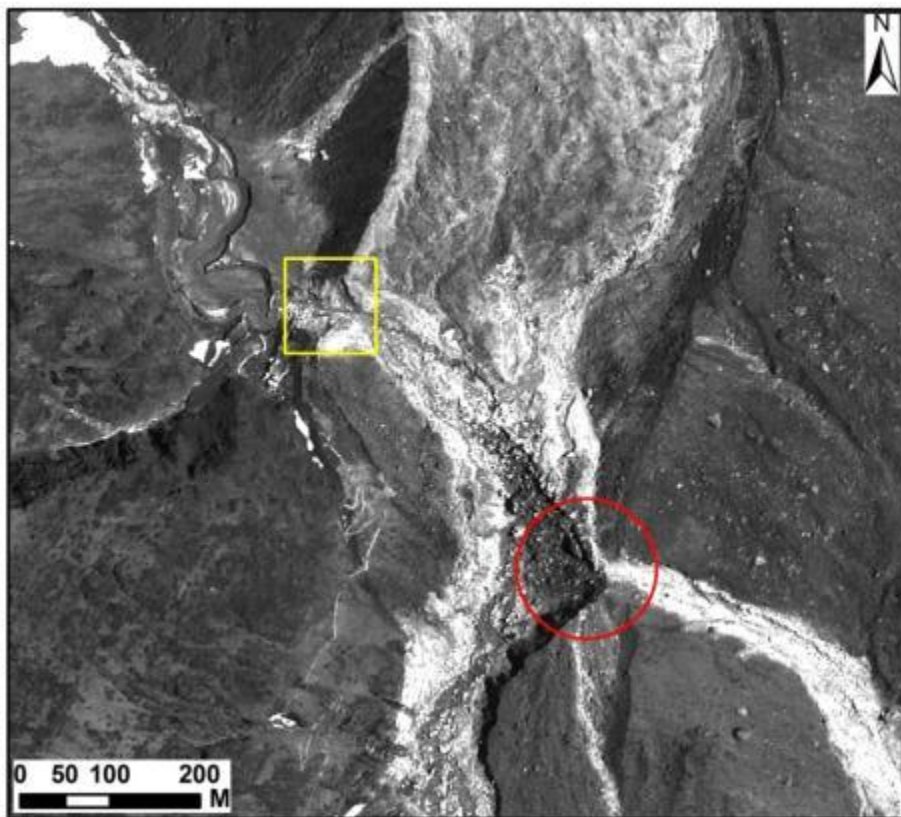
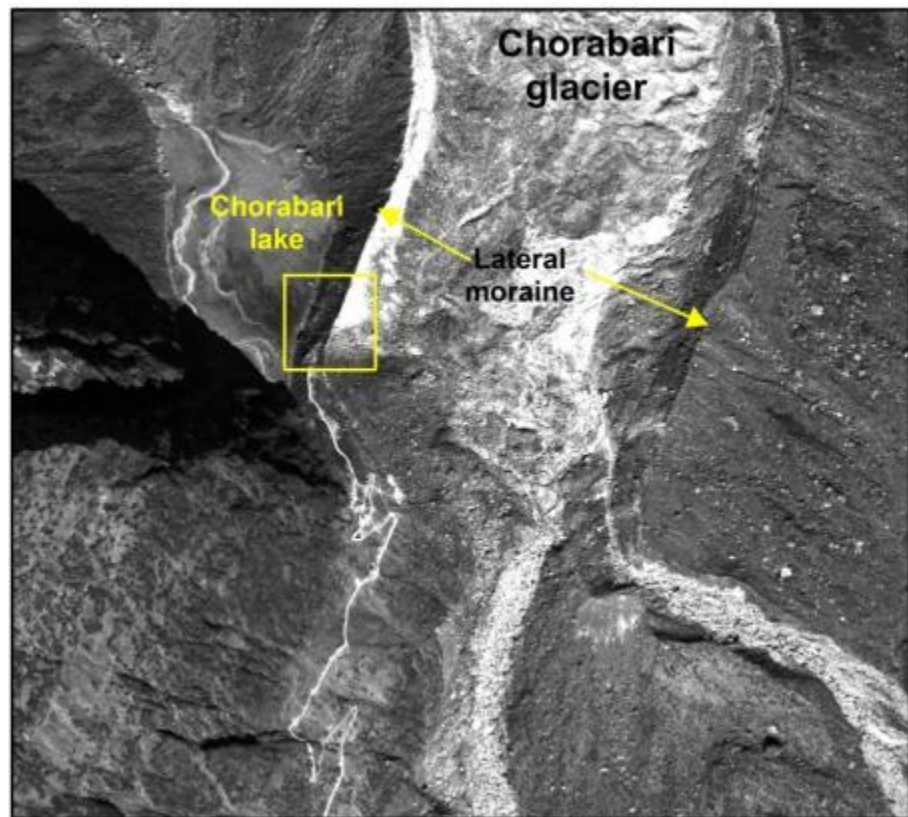
Ground Photos with SatelliteView



Uttarakhand Relief and Reconstruction Collaboration Portal

Chaurabari Lake burst – Kedarnath tragedy (2013)





MANU : Restoration and Rehabilitation support

Gateway to Indian Earth Observation


National Remote Sensing Centre

Bhuvan-2D Enter City or Lat,Lon(ex:chennai or 1

Tools | Updates | Bhuvan Store | Link | Help | Bhuvan Collaborators

Map | Satellite Hybrid Terrain More

POI



Information	Reason of Damage:Others:- earthquake
Posted Time	2013-10-20 16:08:38
Posted By	ajay vipin shyam

Loading...

79.07, 30.66

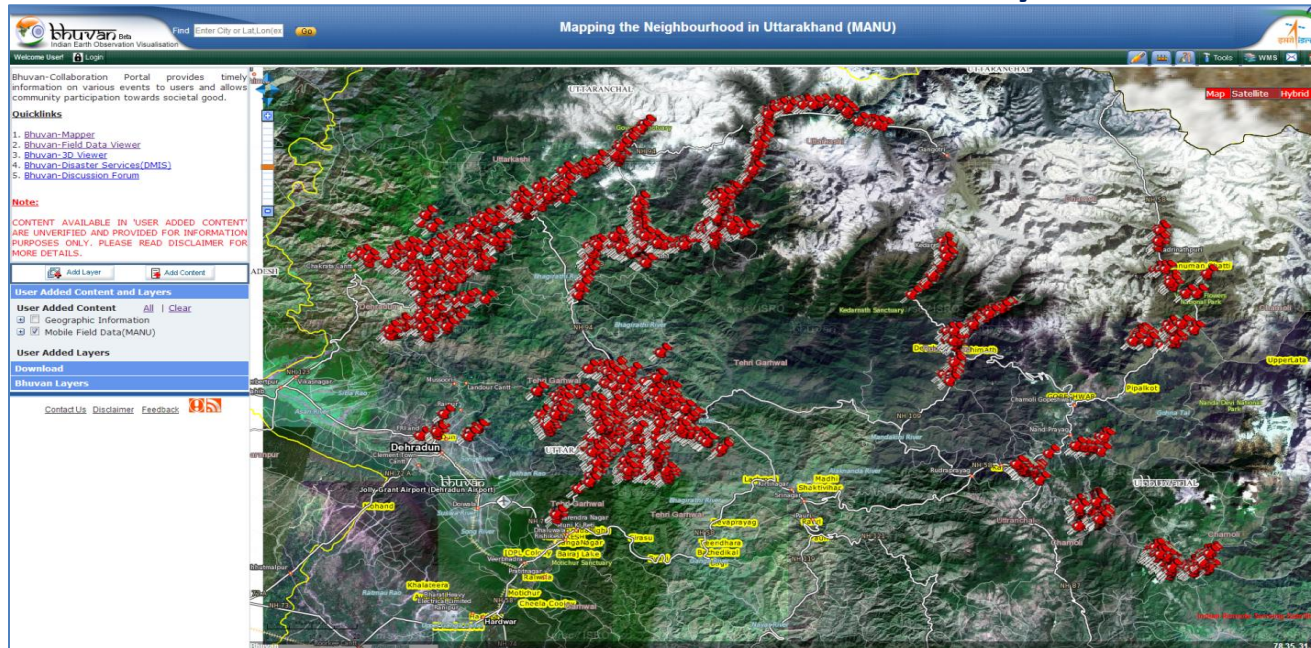
India Remote Sensing Satellites

The image shows a satellite map interface with a Point of Interest (POI) popup. The popup displays a photograph of a damaged building and a table with details about the damage. The background is a satellite map of a mountainous region with labels for Kedarnath, Garuriya, Ghinurpani, and Ratala. The interface includes navigation controls on the left and top, and a search bar at the top.

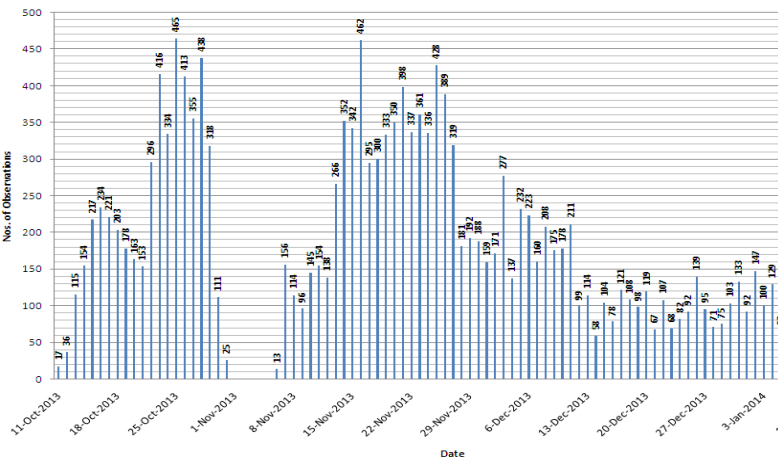


MANU : Collaboraton Portal : Field data Collected from Mobile

“Trained : 150 Students of 3 University ; On Field : 30 Teams of 3 each”



Profile of Day wise data collection



Total No Of Locations Collected ~

19,799

(11 Oct 2013 - 18 Feb 2014)

Bridges or Culverts	- 0185
LandCover and NaturalResources	- 1442
Roads	- 1160
OtherInfrastructure	- 1118
LandSlides	- 3097
RiverBankErosion	- 1022
Buildings	- 2609
BhuvanPOI	- 9146

1 2	
Sl.No	6346
apptype:	fdc
appsubtype:	fdc
FDcprojectname:	MANU
themenam:	MANU
profilename:	LandSlides
observernam:	ajay/vipin shyam
Village Name:	gaunkund
Tehsil Name:	ukhimeth
Affected Feature:	Road,Forest
Settlement Name or Length of Damaged Road/Bridge(approx in meters):	1000
Extent of Damage:	Totally Damaged
Slope:	Steep
Lithology:	Hard Rocks
Land Use / Land Cover:	Open Forest
Landslide Status:	New
Landslide Material:	Debris
Type of Movement:	Slide
Nature of Failure Surface:	Planar
Anthropogenic Activity:	Toe Removal
Remarks:	main road to keidernat
Added Remark:	ok
Remark By:	manunrsc1
Remark on:	2013-11-12 14:10:35.373
<input type="button" value="Accept"/> <input type="button" value="Reject"/> <input type="button" value="Edit"/>	

Moderation : Accept, Reject, Edit, Review & Accept – 15 moderators

Disaster Management Supp

File Edit View History Bookmarks Tools Help

Welcome to Online Ordering S... Welcome to Bhuvan | ISRO's ... Indian Earth Observation Visu...

bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php#

bhuvan
Gateway to Indian Earth Observation

Disaster Services(NDEM Public)

Enter City or Lat,Lon(ex:chennai or 12.9716, 77.5937) **Cyclone | Drought | Earthquake | Flood | Forest Fire | Landslide**

Cyclone NILOFER

Cyclone HUDHUD

Track

Quick Mobile Survey

Crowdsourced Data

Inundation

Forecast

Spatial Overlay

Additional Layers

☒ **Mobile Towers Affected**

Legend

☐ **BSNL Total Mobile Towers**


Legend

☐ **Total Substations**

☒ **Substations Affected**

Share Field Data New

Support for International Disasters



HUDHUD DAMAGE ASSESSMENT & RELIEF MONITORING SYSTEM

Government of Andhra Pradesh

Home Circulars & Go's Gallery Downloads Media Releases Skilled Worker Tracking Telecom Status Power Status Helpline Numbers

Department Login
Username Password LOGIN


Updates
The Hon'ble CM has made an aerial survey of the affected areas & directed all the officials to ensure quick relief operations.
The chief minister has enhanced the relief package to the cyclone victims for human loss, crop damages, house damages etc....
44 IAS officers are appointed to oversee the relief

Citizen Inputs

Maps (Bhuvan)

CM Relief Funds

Gratuitous Relief Update

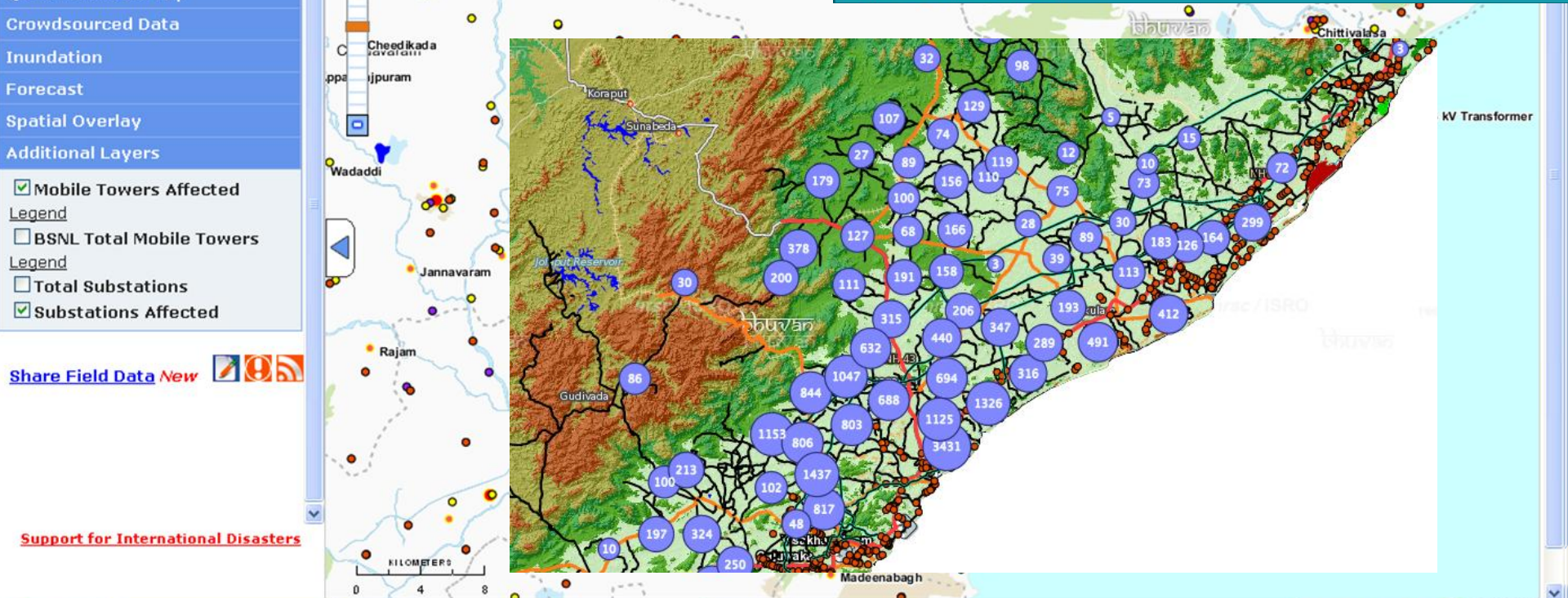


Sri N. Chandrababu Naidu
Hon'ble Chief Minister
Government of Andhra Pradesh

ABOUT HUDHUD CYCLONE
Cyclone Hudhud pounded the coastal districts of Andhra Pradesh and Odisha with heavy rain and winds of almost 200 kmph on Sunday leaving a trail of devastation with Visakhapatnam where the very severe storm made landfall bearing the brunt.
Lakhs of people have being evacuated from towns and villages through which the cyclone has passed amid massive rain and wind. The cyclone is similar to last year's Phailin that crossed the Odisha coast leaving behind a trail of destruction.

Site Best viewed in 1024*768 / Chrome, Firefox, IE+
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Designed & Developed by **APOnline**



Disaster Management Support : Cyclone HUDHUD

bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php

bhuvan
Gateway to Indian Earth Observation

Disaster Services(NDEM Public)

Hudhud Cyclone
Android App Download

Welcome User [Login](#)

National Remote Sensing Centre

Enter City or Lat,Lon(ex:chennai or 13.7611,77.6362)

[Cyclone](#) | [Drought](#) | [Earthquake](#) | [Flood](#) | [Forest Fire](#) | [Landslide](#)

[Tools](#) | [Updates](#) | [Bhuvan Store](#) | [Help](#) | [Print](#)

Cyclone HUDHUD Track

☐ IMD (12Oct14-0230IST)

Source: Indian Meteorological Department - **IMD**

☒ JTWC (12Oct14-0230IST)

Source: Joint Typhoon Warning Center - **JTWC**

Map | **Satellite** | **Hybrid** | **Terrain** | **More**

Quick Mobile Survey

Damaged Feature

All

Remove

Total No of Points Found:24792

- Crop Damage
- Drinking Water/RWS
- House Damage
- Livestock/Fisheries
- Other Building Damage
- People Marooned/Require Relief
- Power
- Tanks/Canal Breach
- Tree Fallen
- Telecom
- Road
- Others

Place: Relli valasa , Pusapatirega , Vizianagaram

Created At: Oct 17, 2014 9:07:05 AM

Category: Transformer Damaged,Power

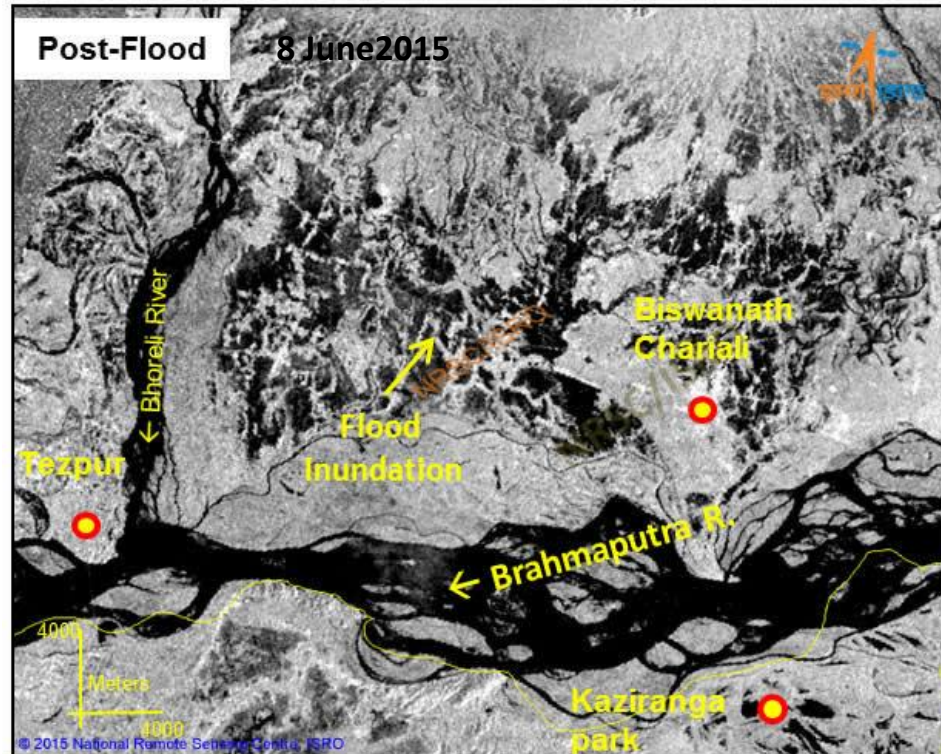
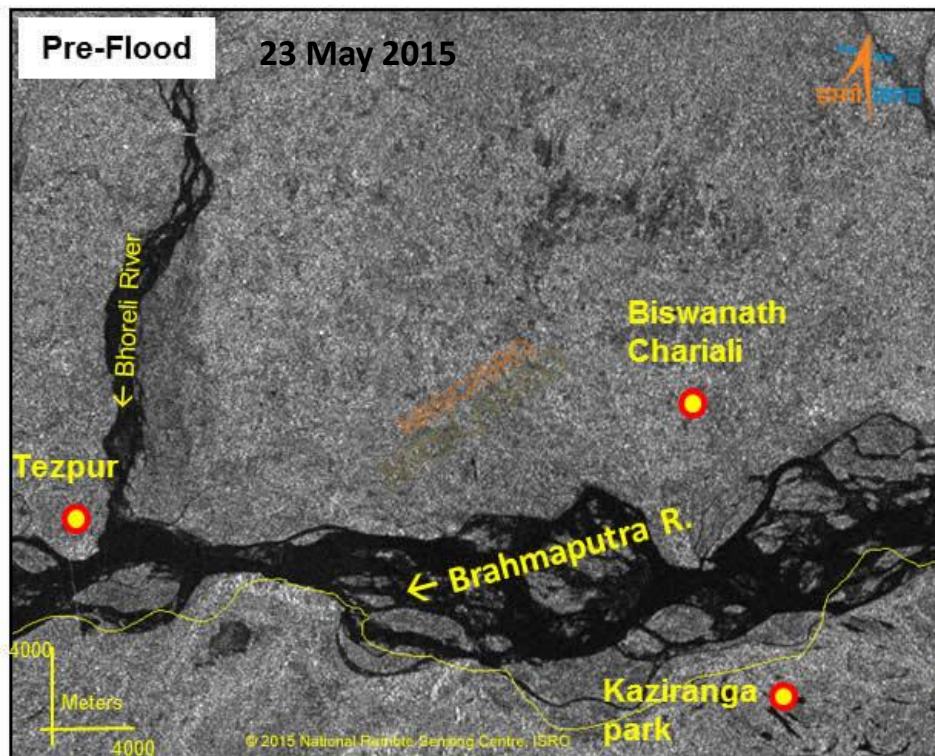
2014-10-17 09:07:05

18.09572032,83.52130074

Map | **Satellite** | **Hybrid** | **Terrain** | **More**

Map Labels: SATHIVADA, PEDATHARIMI, YADA, PYDIBHIMAVARAM, KAMAVARAM, CHITTIVALASA, IIMELLA, KANIMETTA, AHARAM, ALLADAPALEM, BOYAPALEM, RRAVANIPALEM, POKRAM, KOVVADA AGRAHARAM, GOVINDAPURAM, BHARANIKAM, KONAYYPALEM, ROLLIVALASA, PUSAPATIREGA, GUMPAM, ROLUCHAPPIDI, CHOWDUVADA, JUREDDI PALEM, THOTTARAM, CUNTAPALEM.

Floods in Assam – June 15



Disaster Damage Assessment and Response
Live on Bhuvan

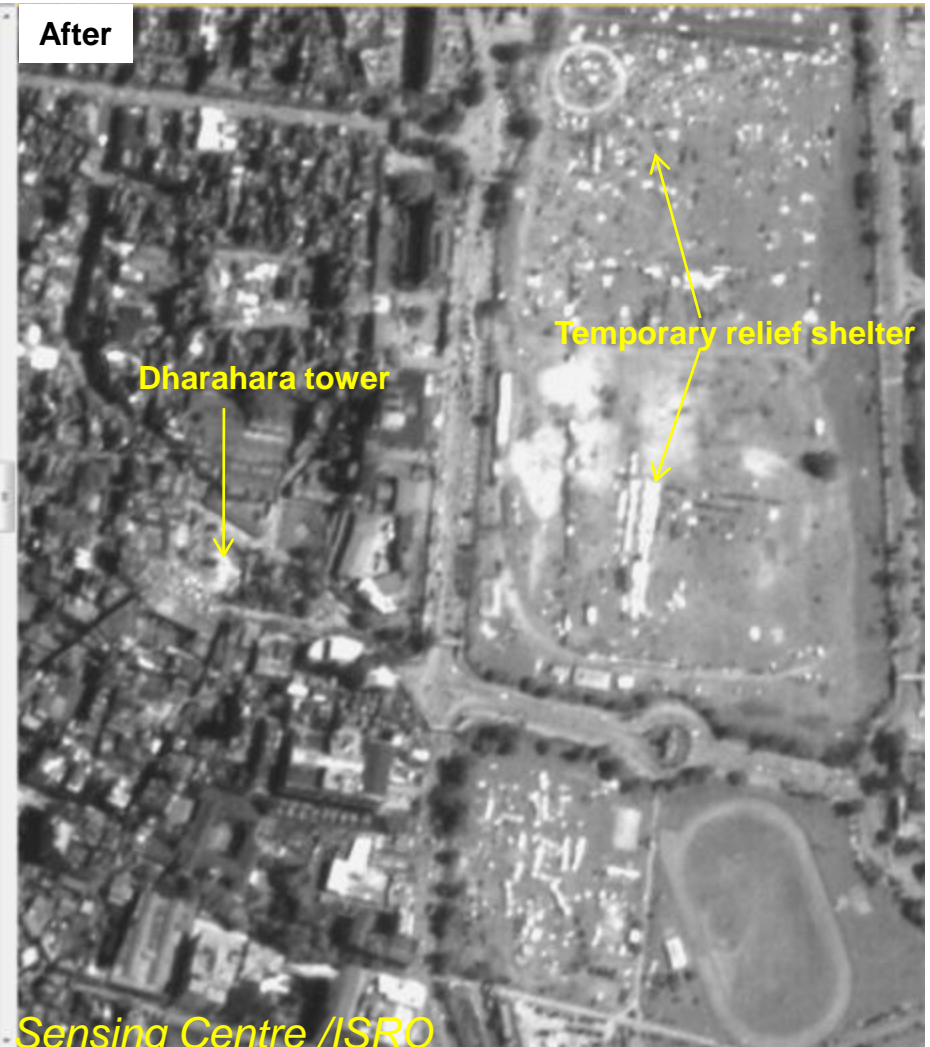
Nepal Earthquake (25-04-2015)

Dharahara Tower, Kathmandu

Cartosat-2 (05-Jan-2015)



Cartosat-2 (27-Apr-2015)



© National Remote Sensing Centre /ISRO

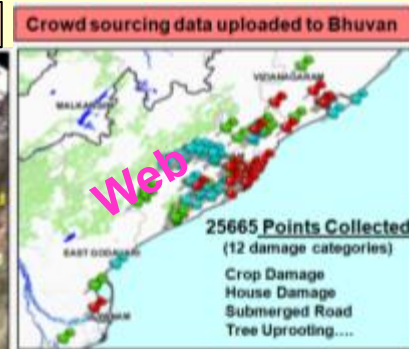
Dharahara Tower, Kathmandu (Plaeides 27.04.2015)



Response to Major Disaster Events - 2014

Cyclone HUDHUD 12 Oct 2014

- Proactive planning
- Close Interaction with Govt. of AP
- Exclusive Bhuvan Pages
- Mobile App Launch
- Aerial data acquisition
- Impact assessment

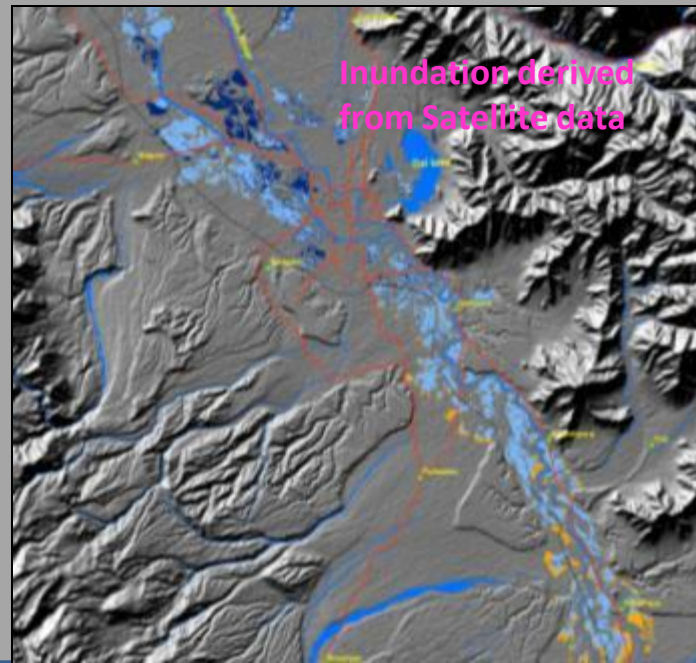


Achievement:

Technological intervention in DM
Helped in Relief operations
Assessment of impact & damages

J&K Floods Sept2014

- Satellite data procurement Analysis
- Flood inundation info
- Inundated villages, roads & railway tracks
- Landslides occurred
- Value added products hosted on ISRO-Bhuvan & NDEM Portals
- Interacted with Govt of J&K
- Established VSAT Connectivity
- Activated International Charter



Phuktal River Blockade, J&K

25-Apr-2015
Cartosat-2 (1 m)

Discontinuity of
Flow

Landslide
Blockade

← Phuktal River

Reference

08-May-2015
Cartosat-2 (1 m)

Channelized Flow
of Water

Landslide
Blockade

← Phuktal River

Breach

50
meters
0 50

2028 lakes - 10 ha and above in Himalaya

477 being monitored 44 ha and above with AWIFS . June-0

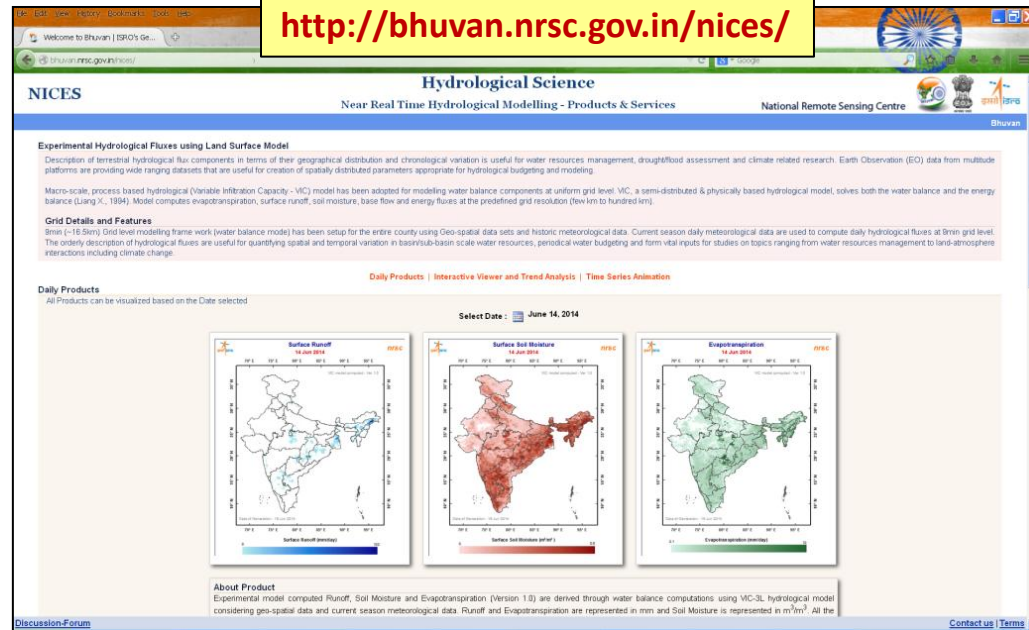
Scale

0 metres 100

Hydrology Outlook - Experimental Near Real Time Hydrological Fluxes

- Framework established to generate daily near-real-time Hydrological fluxes at 9min (~16.5km) grid level for India and SAARC Countries
- Daily field and satellite meteorological data products are used
- Since 01 Jun 2014, Daily geo-spatial products of Surface Runoff, Soil Moisture and Evapotranspiration for India are posted on NRSC website / Bhuvan
- Experimental Hydrological Products extended to SAARC Region, since 01 Jan, 2015

- National /Regional Hydrologic daily/weekly/monthly outlook
- Stream flows/Flows into reservoir for use in RTDSS in forecast mode
- Early Warning/anomalies of Hydrological Extremes

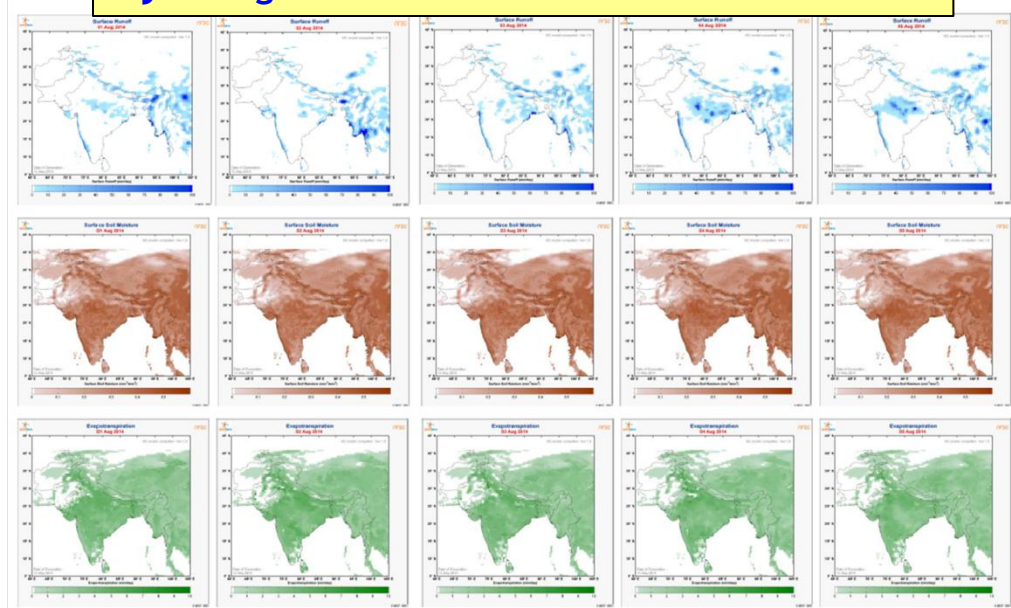


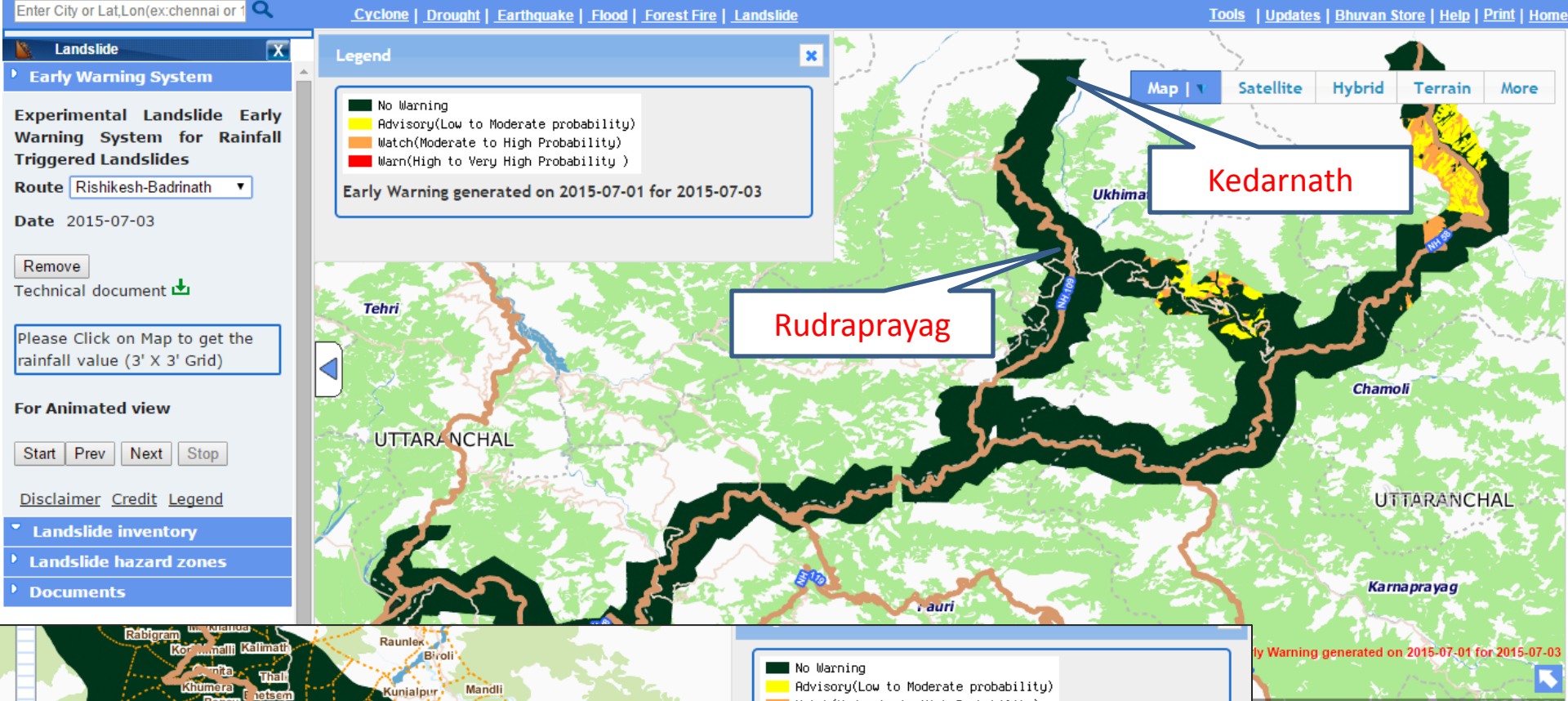
Daily Products

Interactive Viewer & Trend Analysis

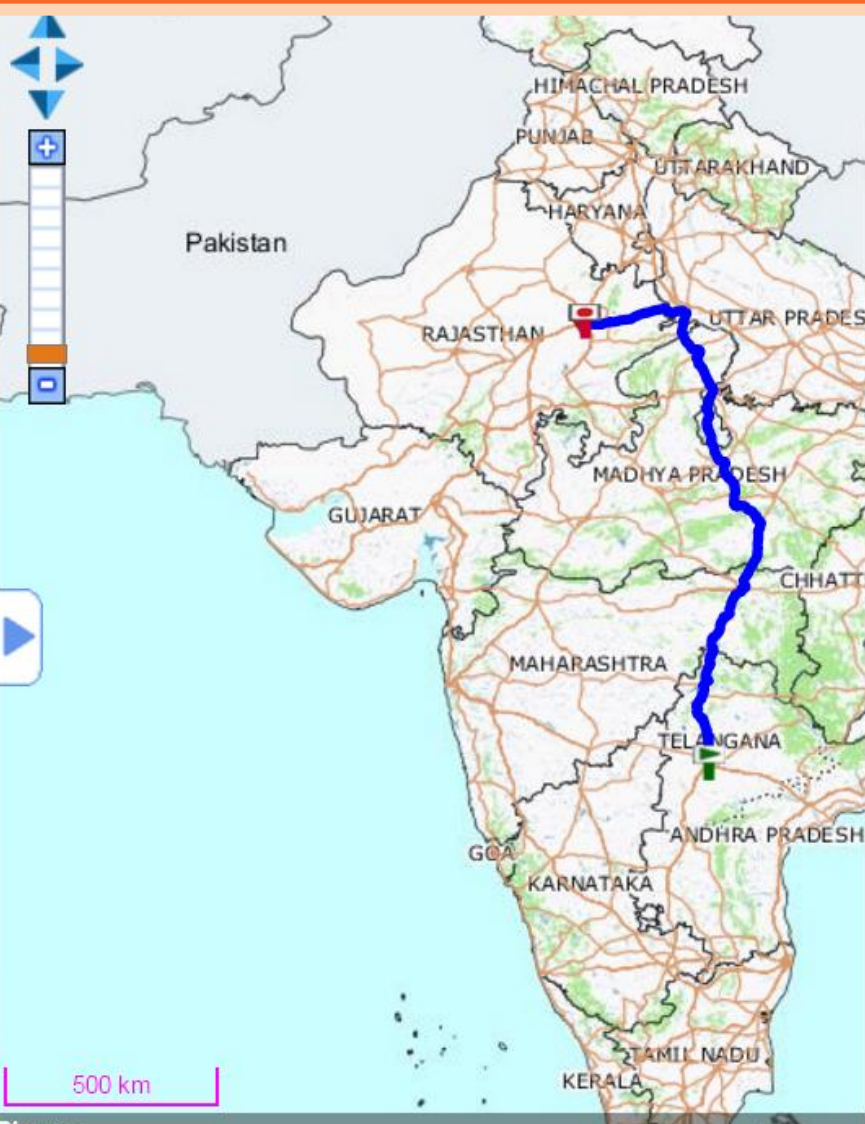
Time Series Animation

Hydrological Fluxes - India & SAARC Countries





Road Network and Navigation



A map of India showing a blue route from Hyderabad, Telangana to Jaipur, Rajasthan. The map includes state boundaries and names: Himachal Pradesh, Punjab, Uttarakhand, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh, Chhattisgarh, Gujarat, Maharashtra, Telangana, Andhra Pradesh, Goa, Karnataka, Tamil Nadu, and Kerala. A scale bar indicates 500 km. Navigation controls are visible on the left.

Map | Satellite | Hybrid | Terrain | More

Get Directions

Start points: Hyderabad, Telangana, India

Via points (optional): Enter address or Location

Destination points: Jaipur, Rajasthan, India

Route type: By Time

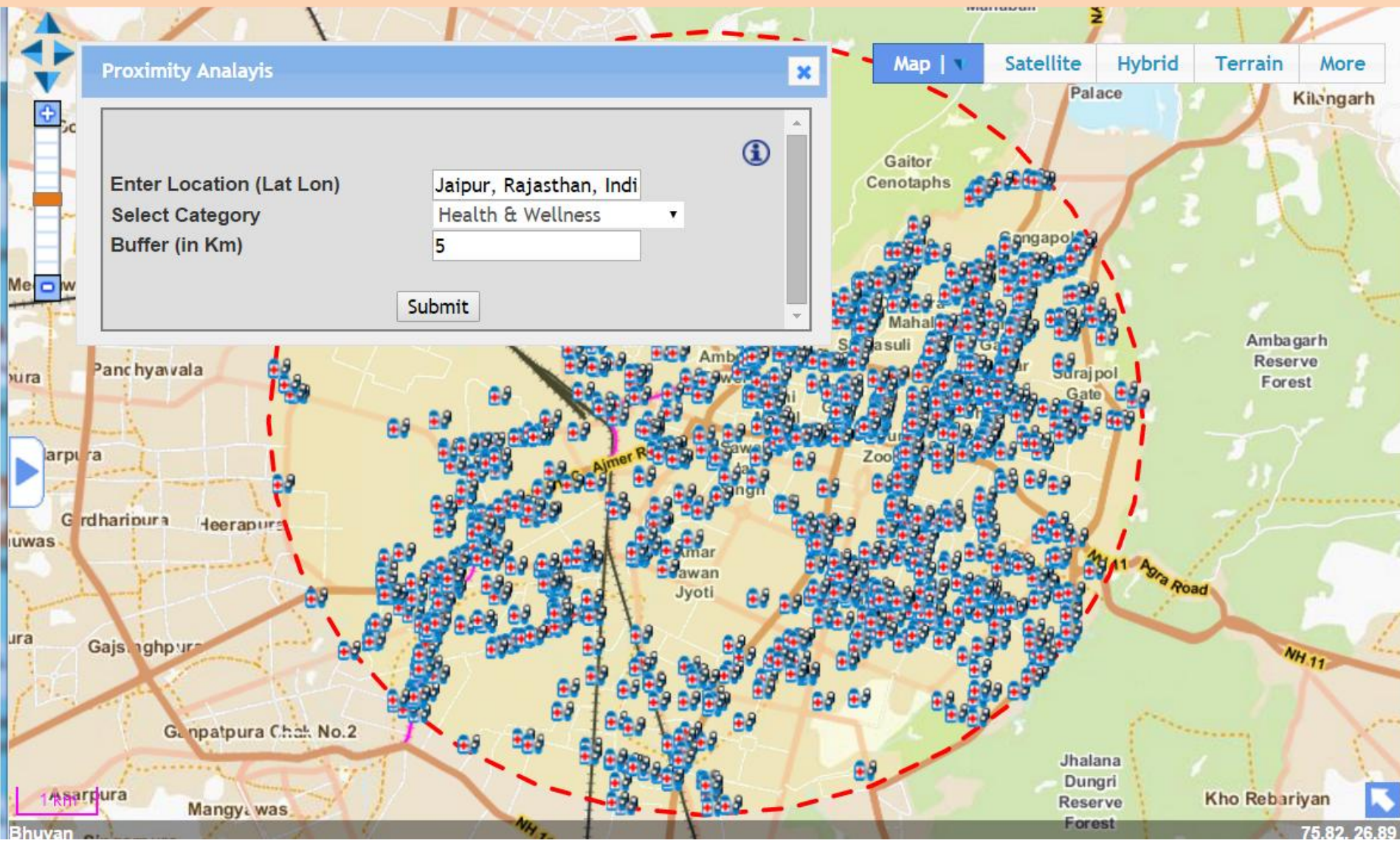
Get Route

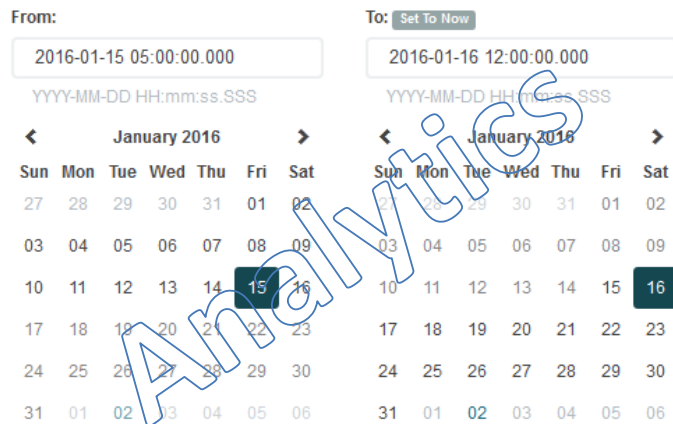
Route 1	Route 2	Route 3
33 hrs 34 min	34 hrs 33 min	37 hrs 57 min
1563.1 km	1440.2 km	1561.8 km

Route 1

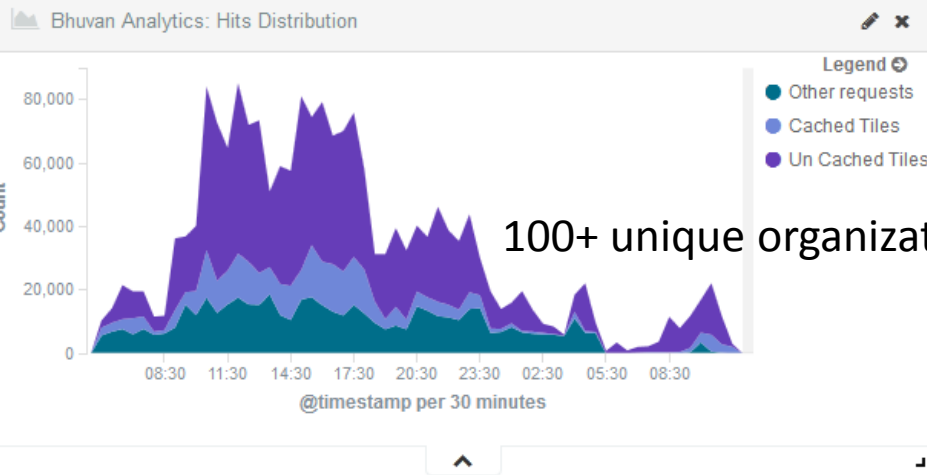
- Head west on Jawaharlal Nehru Road towards Jawaharlal Nehru Road.
Go 24 mts
- Make a **sharp right** turn at NH 7.
Go 173 mts
- At the fork **bear right** onto NH 7 using one of the 2 rightmost lanes.
Go 1.1 km

Points of Interest with Neighbourhood

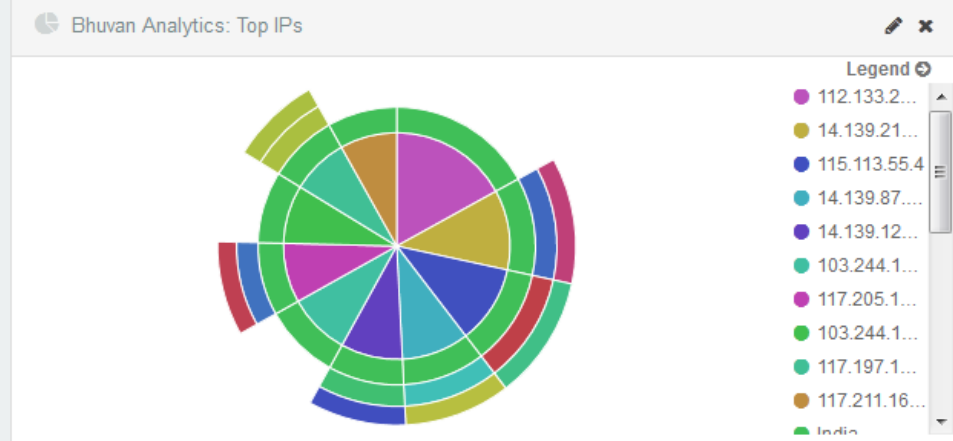
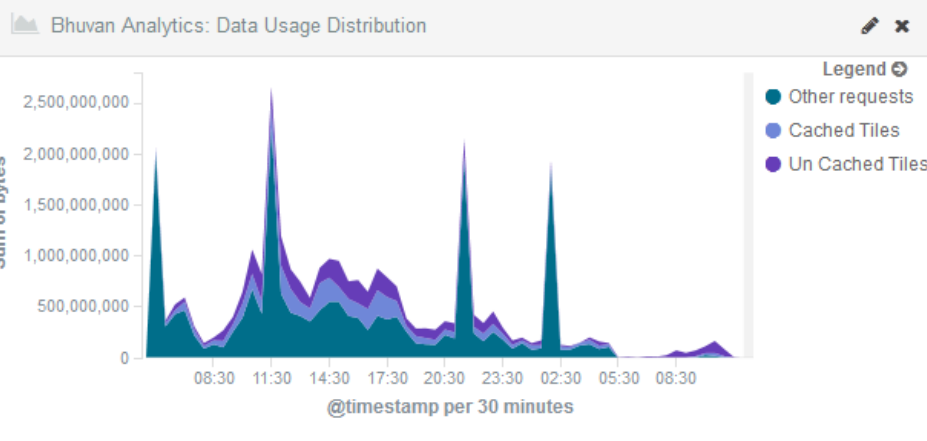
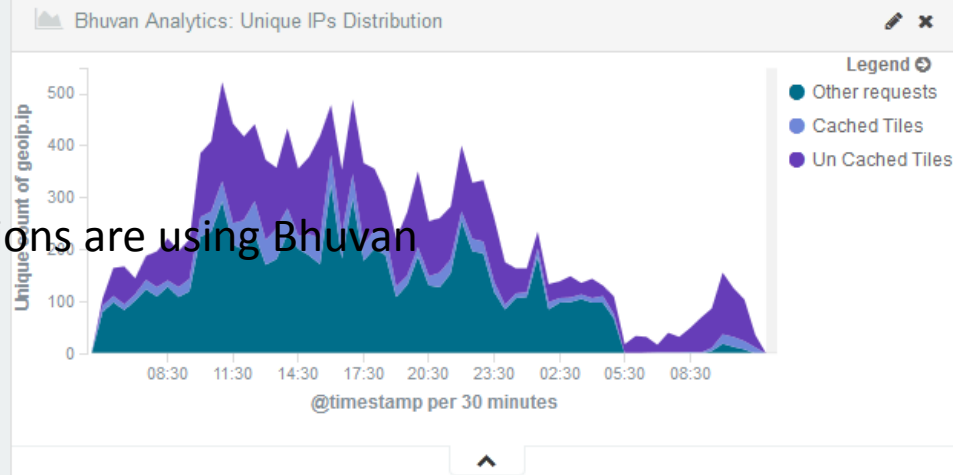




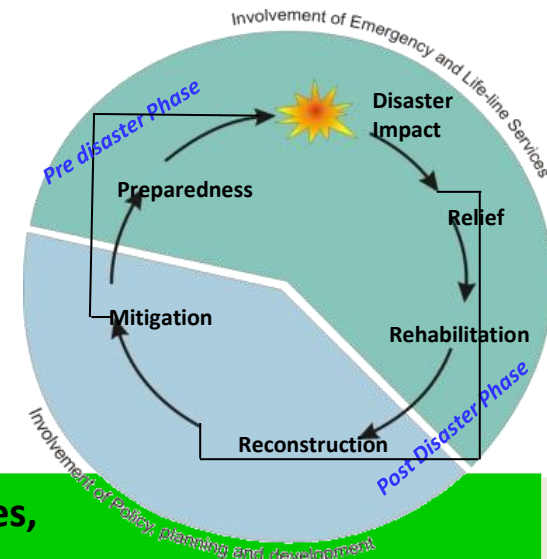
- 100 + Unique organizations are using
- 800 GB of data flow per month,
- 60 Million hits per month
- 70,000 unique IPs per month
- 50 countries - users
- 6200+ map services,
- 4.7 lakhs Free data downloads
- 10 million point of interest information



100+ unique organizations are using Bhuvan



Disaster Management & Risk Reduction



Sub-systems

Early Warning

Early warning for Landslides,
Forecast : Run-off Depth

Risk Information

Info. on terrain, hydrologic, climatic
socio-economic info. Hazard zones,
Historical disaster damages, Drought scenarios

Impact Assessment

Pre and Post event change detection,
identification of damages, assessment, Crowd Sourcing

Preparedness

Creation of vulnerability info. for
developmental planning,
reconstruction

Emergency
Communication

Mobile Apps for Incidence reporting, NDEM Apps for
situational help

BHUVAN SUPPORT

nrsc



Thanks

NRSC EO Data Achieve (NOEDA)

Satellite Data and Carto DEM... 4,43,174
NICES Products 30,640

- **Terrestrial Sciences -21 Products**
- **Ocean Sciences – 18 Products**
- **Atmospheric Sciences – 3 Products**

- **Oceansat-2 OCM Derived Products**
- **Oceansat-2 OSCAT Derived Product**
- **AWIFS Derived Gridded Products**
- **North Indian Ocean Products**
- **Model Derived Products**

SATELLITE DATA / DEM	Downloads
LISS-III	27038
AWiFS	33495
IMS-HySI	7029
CartoDEM	132212
	443174

Downloads

4,74,631

NOEDA: National Information System for Climate and Environment Studies (NICES)

Products	Resolution/ Gridsize	Availability	Frequency
Atmospheric and Climate Sciences			
Derived Tropospheric Ozone	1° x 1°	2010 – 2013	Daily
Ocean Sciences			
Daily Ocean Heat Content	0.25°	2002 - 2015	Daily
Daily Tropical Cyclone Heat Potential	0.25°	1998 – 2015	Daily
Model Derived Depth of 26°C Isotherm	0.5° x 0.5°	2013 - 2015	Daily (15 days lag)
Model Derived TCHP	0.5° x 0.5°	2013 - 2015	Daily (15 days lag)
Ocean Wind Curl	0.5° x 0.5°	2012 – 2014 (Feb)	Daily
Ocean Wind Stress	0.5° x 0.5°	2012 – 2014 (Feb)	Daily
Ocean Wind Velocity	0.5° x 0.5°	2012 – 2014 (Feb)	Daily
Terrestrial Sciences			
AWiFS: Snow Cover Fraction	3' X 3' Grid	2014-2015	15 Days
AWiFS: Water Bodies Fraction	3' X 3' Grid	2004 – 2013, 2014-2015	Monthly, 15 Days
Mesoscale compatible inputs for: MM5	30 sec, 2, 5 mins	2004-05 to 12-13 (9 Cycles)	Yearly
Mesoscale compatible inputs for: WRF	30 sec, 2, 5 mins	2004-05 to 12-13 (9 Cycles)	Yearly
OCM2: Albedo	1 Km	2013 – 2014	15 Days
OCM2: NDVI - Global Coverage	8 Km	2013	Monthly
OCM2: NDVI - Local Coverage	1 Km	2011, 2012-2014	Monthly, 15 Days
OCM2: Vegetation Fraction	1 Km	2011, 2012-2014	Monthly, 15 Days
Snow Melt and Freeze	2.225 Km	2009 – 2013	2 Day
Surface Soil Moisture	0.25° x 0.25°	2012 – 2014	Daily
Surface Soil Moisture - 2 Day	0.25° x 0.25°	2012 – 2014	2 Day

